Large energy consumers have experienced gradual increase in electricity expenditures over recent years[1]. The consequent negative impact on their profitability notes them to pay more attention to managing energy expenditures.

However, a complex billing structure results from the aggregation of electricity charges set by various stakeholders; as these may vary as a function of customer attributes (voltage connection, geographical location or supplier contract) [2]. Together with the influence of socioeconomic, technology or political decisions, all these factors prevent non-domestic customers from establishing straightforward long-term strategies to mitigate potential losses in revenues.

REAL TIME ELECTRICITY PRICE MODEL

**METHODOLOGY**

Component Classification Fifteen charges compose the electricity bill of Profile Classes S and above. These describe singularity in their fluctuations as they may differ spatially across the UK, temporally or with voltage connection. Furthermore, the targeted consumption attribute include: Energy Consumption (kWh), Active Power (kVARh), Reactive Power (kVARh), Capacity (kVA) or fixed. It was thus necessary to find a way to group the billing components appropriately before recreating the electricity bill. Table 1 defines the classification established.

### Table 1. Tariff Classification for Real-Time Electricity Bill Modelling

<table>
<thead>
<tr>
<th>Tariff Classification</th>
<th>Component</th>
<th>Class</th>
<th>Price</th>
<th>Consumption</th>
<th>Supply</th>
<th>Annex</th>
<th>Voltage</th>
<th>Volume</th>
<th>Division</th>
<th>Time</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard kWh charges</td>
<td>ROC, OS, OI, OIRED, Supplier Tariff IT</td>
<td>p/kWh</td>
<td>Yes</td>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Constant</td>
<td></td>
</tr>
<tr>
<td>Pre-Determined charges</td>
<td></td>
<td></td>
<td></td>
<td>Capacity</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Determined distribution tariffs</td>
<td></td>
<td></td>
<td></td>
<td>Member Charge</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Objective Function:** The electricity bill of a large energy consumer was taken as the summation of all tariffs of type 7, multiplied by the corresponding customer-specific attribute $$/kWh$ charges (such as energy usage in kWh or power consumption in kW).

$$\text{Electricity Bill} = \sum_{i=1}^{15} \text{Component}_i \times \text{Price}_i \times \text{Consumption}_i$$

**RESULTS**

### Electricity Bill Profile

Total energy expenses were estimated at £250,152 for the reference store from April 1st 2017 to March 31st 2018. Expenses were dominated by commodity costs (48%), followed by Renewable Obligations (18.9%), and DUDS (6.4%). Prices are highest on week-days and during the winter season, with the occurrence of the punctual triads and Capacity Market.

Spatially, the London region and greater Northern Scotland and lowest in London. The opposite was true for distribution charges. They appeared to increase proportionally to the distance from the North as indicated in Figure 1. The overall impact of distribution costs on overall consumption was found to be smaller as they ranged between £29k and £56k against £69k to £17k during the financial year 2017/18.

**CONCLUSIONS**

Findings indicate that power expenses should nearly double within the next five years for large energy consumers. Prices are highest in winter, and the consumer’s buying habits to the swings in the wholesale market. The impact of peak demand, Time-of-Use, and dynamic tariff pricing are forecasted for the future, with a high degree of reliability. The impact of Brexit on Interconnection projects is yet not completely understood and may have a significant impact on electricity prices as external policy-makers are involved, although that big differences in prices exist between the current wholesale market and that of the future, when the UK had experienced a decline in the electricity market.

**REFERENCES**

